SIMPLE ANTENATAL RISK SCORING

Exploratory study in the
design of a simple risk scoring
form for use by health auxiliaries
in Malaysia

By

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1. INTRODUCTION

1.1 The perinatal period (that is, the period from 28 weeks gestation to the first week of life), inspite of its shortness, has been recognised as a very critical period in the human life span, contributing greatly to deaths from immediate as well as long term diseases (W.H.O. Technical Report Series No. 600, page 20). The developing conceptus interacts with multiple factors in the mother, such as age, parity, height, socio-economic status and past obstetric history in a highly complex manner. Also, these factors are likely to be interdependent in their influence on the pregnancy outcome.

Multivariate analysis of the findings of the British Perinatal Mortality Survey of 1958 has singled out the following factors as having a major influence on perinatal mortality (W.H.O. Public Health Papers No. 42).

(i) The social and biological characteristics of the mother and of these age, parity, height and socio-economic circumstances were considered of great importance.

(ii) The obstetrical history: It was shown (Febvay and Croze, 1954) that a history of previous abortion, perinatal death, the birth of a live child weighing less than 2,500 gm, toxaemia of

pregnancy, antepartum haemorrhage or caesarean section indicated an increased risk of perinatal mortality in subsequent pregnancies.

(iii) The course of gestation: Toxaemia for example is being shown to carry a high risk of foetal loss especially when associated with proteinuria and when of early onset.

(iv) The birth weight of the baby.

From these types of statistical data, it is possible to define the characteristics of the pregnant woman who represents a high risk from the point of view of perinatal mortality. Such patients might benefit from intensive care to minimise foetal loss.

However, resulting from limitations in personnel and resources, an accurate identification of patients requiring different levels of care has become a major concern. In response to this need, a risk scoring approach has been attempted by several investigators.

Risk scoring may be defined as a formalised method of recognising, documenting and cumulating antepartum and intrapartum factors or only antepartum factors in order to predict later complications for mother, foetus or infant (Sokol, et al., 1977). It is based on the concept that abnormal conditions tend

to occur together and may act synergistically as risk factors, producing a cumulative effect, as noted by Prechtl (1967) and Goodwin, et al. (1963). The latter showed that as the number of adverse obstetric factors such as toxaemia, postmaturity and prolonged rupture of membranes (which are themselves associated with an increased foetal risk) superimposed on the basic event of prolonged labour (more than 20 hours) increased (0 to more than 4) the perinatal mortality increased in a cumulative fashion (1.1 per cent to 28.6 per cent). Thus, patients with the lowest number and least severity of risk factors might be expected to have the best outcomes, and patients with the greatest numbers and most severe factors the worst outcomes.

Several risk scoring systems have been proposed and have been shown to relate to perinatal outcome. Nesbitt, et al. (1969) developed a semiobjective grading system based on adverse factors considered at the first antenatal visit in their clinic. A study of 1,001 consecutive patients allowed division into low, moderate and high risk pregnancies. Of these, the latter group represented approximately 30 per cent of their total and was found to account for 60 per cent of all pathological outcomes to the foetus.

Goodwin, et al. (1969) developed a similar scoring system using risk factors identifiable in early pregnancy, those that develop during pregnancy and the gestational age at labour for

scoring the antenatal mothers. By this system, patients with no adverse factors obtained a score of zero and the worst score attainable was 10. Applying this to a number of obstetrical patients, they found that none of the perinatal deaths scored zero and none of the nondepressed newborns occurred in patients whose score was more than 6. They also found a highly significant correlation of the score with urinary oestriols, the higher the score, the lower the oestriol. Unfortunately, no effort was made to establish the percentage of obstetric population that was identified to be at risk, and what proportion of perinatal mortality they accounted for. Nevertheless, these and other studies that will be referred to later indicate the practical potential of semiobjective methods to identify the high risk foetus.

In the present study, an attempt has been made to devise a scoring form based on these scoring systems modified to be applicable to local needs in detecting the foetus at risk. This method of detection of high risk individuals can be used in providing more care at the individual level for those at risk and allow for flexible and more rational distribution of existing resources according to the level of risk. Thus, some care can be provided for all, but more skilled care for those at higher risk.

In England and Wales, it was shown that by the focusing of

attention upon the high risk group they have been able to appreciably influence the progressive decline in perinatal mortality which fell from 35.0 per 1,000 in 1958 to 26.3 per 1,000 in 1966 (John Peel in Second Report of 1958 Perinatal Mortality Survey). This has dropped further to 20.6 per 1,000 livebirths in 1974 (World Health Statistics Annual, 1973 - 1976).

In Malaysia, where obstetrical care is still being provided by auxiliaries to 70 per cent of the population (Chen, 1977), such an approach would assist in reducing the present perinatal mortality rate in the country. The earliest perinatal mortality rate for Peninsular Malaysia available is for 1971 and this was 37.2 per 1,000 livebirths and 34.5 per 1,000 livebirths in 1974 (World Health Statistics Annual, 1973 - 1976 and 1978).

1.2 Problems in Malaysia

Prior to Independence in 1957, the rural areas of Malaysia, where three-quarters of the population live, were largely neglected in so far as the health services were concerned. After Independence, the government began a major drive to provide primary health care particularly for mothers and children in the rural areas of Malaysia.

In planning, the temptation is always to provide the "best" - a physician-manned service. However, physicians are not only scarce but also require a long and costly training process. They

are also expensive to employ. In Malaysia physicians cost from 4 to 8.3 times more than auxiliaries each working day (Chen, 1973). Not only that, but the requisite professional and social environment also has to be supplied for work satisfaction (Fendall, 1968). This can be provided in major towns but not in the rural areas. Hence, it is not surprising that 29 per cent of the 3,058 doctors in East and Peninsular Malaysia (including those in private practice) are found in the Federal Territory, the location of the capital city, Kuala Lumpur (Ministry of Health, 1978).

The rural areas in turn are served by rural health units which comprise of one main health centre, four health subcentres and 20 midwife centres to serve a population of 50,000. These are staffed mainly by auxiliaries and paramedicals with one Medical and Health Officer (a doctor) as the team leader. These rural health units are supported by the relatively well established network of existing hospitals located in all the towns to which illness requiring more extensive treatment can be referred.

In a setting like this, where 70 per cent of the population is being served by auxiliaries and supporting hospital services in major towns, a simple method for detecting a mother at risk would be a useful device for early detection and referral of cases for appropriate management.

2. OBJECTIVES

From the foregoing, it would be of great advantage if a simple scoring system for the identification of high risk pregnancies which could be used by auxiliaries in rural areas be formulated. This study therefore has the following objectives:

2.1 Overall

To perform an exploratory study in the formulation of a simple antepartum risk scoring form for the identification of the foetus at risk, based on information that is routinely obtained from an antenatal mother in a rural health clinic in Malaysia.

2.2 Specific

(i) To formulate a simple antepartum risk scoring form which can be used by auxiliaries to identify the foetus at risk.

(ii) To test the form so designed, on antenatal mothers attending selected rural health clinics in order to determine the efficacy of the form in identifying the foetus at risk.

(iii) To show whether there is any relationship between the score and outcome to (a) the place of delivery and birth attendant and (b) the period of gestation at delivery.

3. METHOD AND MATERIALS

There were 2 main components in the present study, the first of which was the designing of the form stated in the objectives. The second part consisted of the evaluation of the form in identifying the foetal population at risk. A plan of action to carry out the study was then formulated. This plan is shown schematically at the end of this chapter on page 33.

3.1 Designing of the form

In designing the form it was kept in mind that it would be used by auxiliaries, in this case, government midwives and jururawat desa (community nurse) with limited training and capabilities. Hence, the factors that were selected for scoring the risk were based on those that could be assessed by the midwife or jururawat desa. Also, in order to cause only the minimum disruption of the existing system used by these auxiliaries, the factors selected were those that are already routinely assessed by them.

The literature was reviewed to find suitable scoring systems which can be used as an index form for the formulation of the form for the study. Four forms were found (Appendix A to D). Two of these, the one designed by Nesbitt et al. (1969), and Goodwin et al. (1969) have been described briefly in the introduction. The other two are those designed by Wilson et al. (1973) and Coopland et al. (1977). The antenatal recording card

which is currently being used for recording the examination findings in an antenatal mother attending a clinic in rural areas in Malaysia is shown in Appendix E.

3.1.1 Selection of factors

Based on the four scoring systems and the antenatal card used by the Ministry of Health the following factors were decided on for use in assessing the foetal risk.

(i) Maternal age

(ii) Parity

(iii) Height

(iv) Rhesus grouping

(v) Past history of

(a) previous pregnancy loss - abortion
- stillbirth

(b) surviving low birth weight baby

(c) baby more than 9 lbs.

(d) postpartum haemorrhage

(e) antepartum haemorrhage

(f) preeclamptic toxaemia

(vi) Associated conditions

(a) hypertension

(b) tuberculosis

(c) cardiac disease

(d) diabetes

(vii) Condition in present pregnancy

(a) Anaemia

(b) toxaemia of pregnancy - blood pressure

- albumin

(c) bleeding per vagina in antenatal period

(d) presentation

(e) multiple pregnancy

(f) VDRL (Venereal Disease Research Laboratory) reactivity.

All the above were selected based on the fact that the particulars of these are routinely obtained from all antenatal mothers.

Factors that were found in the scoring forms but were excluded because it was felt that they were not within the technical capabilities of the midwife were endocrine disorders, reproductive tract disorders, social and emotional assessment which would require too much of the personnel's time and moreover the distinction between the various subcategories is vague.

Factors which were not found in any of the scoring systems but included in the study form was urine sugar because it is one of the tests that is carried out as a routine during an antenatal visit and was considered a

simple method for detecting a mother who may develop gestational diabetes or a diabetic who is still unaware of the fact.

3.1.2 Selection of the scoring system

Having selected the factors, a decision had to be made on which scoring system should be used as an index for designing the study form.

The following criteria were considered:

(i) The scoring system should be easy to understand

(ii) The scoring system which could be adapted with the minimum of modifications.

In reviewing the available systems, that of Coopland et al. closely met this criteria and was therefore adapted with some modifications to suit the local context and the category of staff for whose use it was designed. Hereafter, the scoring system used by Coopland et al. will be referred to as the index form and the form that will be used in this study as the study/designed form. The factors that were selected and the scores that were given to each factor were kept intact as far as possible. However, adjustments were made to suit the local context whenever it was felt necessary. For the study/designed form, the factors were arranged in a multiple choice format.

Under any one factor one choice may be selected and the corresponding score entered into the box provided. Scores for positive factors could then be added up to yield the risk score. This was done so that it would be easier for the auxiliaries to score risk factors.

3.1.3 Review of each factor

In the following paragraphs each factor selected will be reviewed to show how each factor affects perinatal mortality wherever data was available.

(i) Maternal age:

Perinatal mortality rate has a J-shaped curvilinear (Appendix L and M) relationship to both age and parity (W.H.O. Technical Report Series No. 457). This has been shown by various analysis, but the age classification varies. Butler and Bonham (1963) showed that for a given parity the risk of perinatal death is lowest in the age group 20 - 29 years and increases rapidly with the age when the mother is over 30 years. The perinatal mortality was also shown to be high under 20 years of age. However, Feldstein and Butler (1965) demonstrated by multivariate analysis that this increased risk in those below 20 years of age, is related to poor social and economic circumstances and to the relatively large

number of first births rather than to the low age of the mother. Horger et al. (1975) and the University Hospital analysis of perinatal mortality (1977) also show a three-fold increase in perinatal mortality in women over 40 years of age as compared to overall perinatal mortality.

The scoring in the index form also uses this curvilinear relationship mentioned above. Although Feldstein and Butler showed that there was no significant rise in the perinatal mortality for mothers less than 20 years, the score used in the index form was retained since no score is given for social class.

(ii) Parity:

As for parity, an analysis of perinatal mortality in the University Hospital (1977) showed an increase in perinatal mortality in women with parity 5 or more. Baskett's six-year review of grandmultiparity (parity more than 5) and the study by Ariffin Marzuki (1970) also showed a similar trend for grandmultiparity. The highest perinatal mortality occurred in the highest parity and the lowest in mothers having their second baby (Butler and Bonham, 1963). The perinatal mortality in primipara was found to be higher than the national average.

The scores for this factor in the index form are consistent with the studies quoted. Besides they are also consistent with the criteria set by the Ministry of Health in Malaysia for referral of antenatal mothers to hospital for delivery, i.e. all primiparas and grandmultips. Hence the scores were retained, as used in the index form.

(iii) Height:

This has not been used in the index form but was included in the study form because it is information which can be obtained easily and is said to have a negative linear correlation to perinatal mortality rates (W.H.O. Technical Report Series No. 457). It was felt that this would be a good index of the cases that would probably have problem of cephalo pelvic disproportion. Bernard (1952) has shown that antero-posterior contraction of the pelvic brim is commoner in short than in tall women. The division was arbitrarily put at five feet and a score of 1 given to women less than 5 feet tall.

(iv) Rhesus grouping:

As quoted by Freda (1973), in retrospective studies done on the Rhesus problem it was found that if a strict policy of non-interference in managing the

Rhesus sensitised women is adhered to, the perinatal mortality rate will be approximately 30 per cent of such pregnancies. With an aggressive programme, including repeated amniocentises, intrauterine transfusions (in selected cases) and premature delivery, the rate can be lowered to 10 per cent. Besides, a mother who has not been isoimmunised can be prevented from becoming so, by administration of Rhogam,hence the importance of early detection.

In the index form, a score of three is given to a Rhesus isoimmunised mother. However, an auxiliary is only capable of picking out those mothers who have Rhesus negative blood and hence a potential risk of developing isoimmunisation based on laboratory results. Since not all Rhesus negative pregnancies have isoimmunisation problems only a score of 2 is given for this factor if a mother is found to have Rhesus negative blood.

(v) Past obstetric history:

Previous pregnancy loss:

A patient's past obstetric history gives a good indication of her capacity for successful pregnancy. Perinatal and early pregnancy loss has been shown to recur in a given patient (W.H.O. Technical Report

Series No. 457). Frederick (1977) in his study showed that the risk of perinatal death to the foetus in the present pregnancy is increased by 1.6 times if the preceding delivery is an abortion. This risk is increased by three times if preceding delivery ends in a stillbirth or neonatal death and six times if the two preceding deliveries end in stillbirth or neonatal death. The University Hospital (1977) figures for perinatal mortality also show that the mortality is increased by 1.8 times if the mother has a history of more than two previous abortions.

Based on this, the scoring for history of previous abortion was retained at 1 as in the index form. However, the score for previous history of stillbirth or neonatal death was further subdivided depending on whether there was one or more than one of such occurrences. A score of 2 was given if there was a stillbirth or neonatal death in the immediately preceding pregnancies and 3 if there were more than 1 stillbirth or neonatal death in the preceding pregnancies.

Surviving low birth weight infant:

Perinatal mortality was found to be considerably higher (1.8 times) for all patients who had a previous live-born infant weighing less than 2,500 gm. (Butler

and Bonham, 1963). Hence, as for previous history of abortion a score of 1 was given if there was a history of low birth weight infant in the previous pregnancy.

Baby more than 9 lbs:

Since large babies are one of the commonly associated features of diabetic or prediabetic patients, this was also given a score as in the index form.

Previous caesarean section, toxaemia or antepartum haemorrhage:

According to Butler and Bonham (1963) with the presence of any of the 3 factors in the past obstetric history the perinatal mortality was considerably higher up to 1.3 to 1.9 times higher than if there was no past history of any such conditions. The score was not changed. Further a history of antepartum haemorrhage was also included in the scoring and given a score of 1.

Previous long labour or difficult delivery:

A history of this would be difficult to obtain from the patient as she would not be able to give an accurate length of time of the labour especially if it was a home delivery and hence this was not included.

(vi) Associated conditions:

Under this section, a number of changes were incorporated to make it suitable for use by auxiliaries since their level of competence in detecting these conditions is limited and based primarily on the history given by the patient.

Previous gynaecological surgery/chronic renal disease/ chronic bronchitis and lupus:

A history of all these conditions is not obtained as a routine and it is difficult to obtain such history from an uneducated mother and was hence left out. Chronic renal disease was however replaced by hypertension, a history of which was more easily obtained and quite often one of the complications of chronic renal disease. Chronic bronchitis was replaced by tuberculosis which is an endemic disease and better known to auxiliaries as well as rural mothers. Besides, a history of this is routinely obtained. A score of 2 was given.

Heart disease and diabetes:

For this too, the auxiliary will have to depend very much on the history given by the mother but since it is routinely asked in the history it was included and the score that was given was as in the index form. However, to facilitate discovery of any

mother who is unaware that she is a diabetic, urine sugar has also been used in scoring. Perinatal mortality rates associated with insulin dependent maternal diabetes amount to 30 per cent or more when facilities are limited (Carrington et al., 1973). In the University Hospital, the perinatal mortality among infants of diabetic mothers was 6 per cent. This was 2.5 times the overall perinatal mortality rate in the hospital.

(vii) Conditions in present pregnancy:

Anaemia:

Malnutrition and severe anaemia adversely influence the course and outcome of pregnancy, affect foetal growth and birth weight, and hence contribute significantly to perinatal mortality. Llewellyn Jones (1968) observed that stillbirth ratio in the anaemic mothers was 91.0/1000 livebirths which was six times that in non-anaemic mothers, 15.7/1000 livebirths. The level of anaemia that was considered as a cut-off point was less than 6.5 gm. per cent.

The University Hospital analysis of perinatal mortality in anaemic mothers showed that it was only 0.6 times that of the overall perinatal mortality rate. However, the anaemia here was defined as less than 10 gm. per cent and other complications which

might have anaemia as an associated factor were not included. Hence, the low perinatal mortality rate was observed in anaemic mothers.

Since anaemia is common in this country, for the study form, anaemia was further subdivided into less than 8 gm. per cent, 8 to 10 gm. per cent and more than 10 gm. per cent and assigned scores of 2, 1 and 0 respectively.

Toxaemia of pregnancy:

Studies by Hendricks et al. (1971) showed that perinatal mortality rate among infants born to toxaemic mothers was 33.8/1000 births. De Alvarez (1973) stated that the presence of proteinuria significantly influences the perinatal prognosis, independently of blood pressure, except in nephrotic syndrome in association with some renal diseases. The rates of perinatal mortality with proteinuria are significantly elevated above those of pregnant patients with proteinuria but with equal levels of hypertension.

In the index form hypertension was the only indication of toxaemia of pregnancy, but for purposes of making it clear and easy to score, different scores were given to different degrees of elevation in blood pressure. The absence or presence of albumin

was also used in scoring since the examination of albumin in the urine is a routine procedure for an antenatal examination.

Bleeding per vagina in present pregnancy:

Bleeding in early and late pregnancy due to whatever cause indicates a high risk conceptus (W.H.O. Technical Report Series No. 457). The University Hospital analysis of perinatal mortality in mothers with antepartum haemorrhage showed an 8.1 times increase over the overall perinatal mortality rate. The scoring for this factor was, however, retained as in the index form.

Presentation and multiple pregnancy:

Breech deliveries have been shown to result in high perinatal mortality risk. Olavi Kaupilla (1975) demonstrated that breech deliveries have a 6.4 times higher mortality than in non-breech deliveries. The analysis of perinatal mortality for breech deliveries in the University Hospital also showed a 4.8 times increase over the overall perinatal mortality. Fiani (1976) showed that "passive" management increases the risk by 2 times when compared with "active" management in breech deliveries.

Petterson et al. (1976) showed in their study

that full term twins had 5 times the perinatal mortality rate of the full term single born. According to Farooqui et al. (1973) the percentage perinatal mortality with twin deliveries was 9 per cent and the delivery of the first or second twin by breech was associated with a 3 to 5 fold increase in perinatal mortality as compared to vertex delivery. The risk also increases with increasing prematurity from 4 per cent perinatal mortality at less than 37 weeks to 59 per cent perinatal mortality at 35 weeks.

Since malpresentation in a twin pregnancy is an added risk to the foetus and also to make it easier for the auxiliary to score, malpresentation and twin pregnancies have been scored individually in the study/ designed form with a score of 3 each.

Pregnancy more than 42 weeks:

Uterus larger than dates:

Uterus smaller than dates:

All these were not included in the risk scoring form since many midwives find it difficult to carry out this calculation and from the writer's experience it is found that approximately 10 per cent of mothers do not know the date of their last menstrual period.

Urine sugar:

As stated under the heading of diabetes, this has been included as one of the factors in the study/ designed form. It is a simple method for detecting a mother who has gestational diabetes or a diabetic who is still unaware of it. Besides, it is also a routine test done during each antenatal visit.

Sutherland et al. (1970) have shown that in women with a positive reaction for the second fasting urine sugar there is a significant correlation with gestational chemical diabetes. In those with fasting glycosuria an impaired glucose tolerance test was found in 15 per cent so tested. In their experience the fasting type of glycosuria presented as the only indication of impaired glucose tolerance in 6 per 1,000 in an antenatal clinic population. Hence, a score of 2 was given to a mother with a fasting type of glycosuria.

VDRL (Venereal Disease Research Laboratory) Test:

Syphilis has been described as one of the infectious diseases especially common in developing countries which may have an intensified effect on the pregnant woman and seriously influence the foetus (W.H.O. Technical Report Series No. 457). Stillbirths occur in about one-fourth of such affected pregnancies

(Sever, 1973). The importance of early detection of syphilis in a mother is further emphasised by the following fact. Benirschke (1974) has pointed out that of the many congenital infections, syphilis is not only the most readily prevented but it is also the most susceptible to therapy.

Although syphilis has not been used as one of the factors for assessing foetal risk in the index form, it has been used by the form designed by Nesbitt et al. It has also been included in the study/ designed form. The results of the VDRL test, which is routinely done for all primips and multipara with a bad obstetric history, has been used as an indicator of syphilis and a score of 2 given if the test is positive.

3.2 Part II of the form

This concerns the outcome of the pregnancy. Two measures of outcome were chosen for assessing this and they were:

(i) Whether the pregnancy resulted in a livebirth which remained alive after 1 week or a perinatal death. For this the condition of the foetus at birth was noted and in the case of livebirth the condition after one week was also noted.

(ii) The Apgar score at 1 minute and 5 minutes.

Besides the above, a note was also made of the birth weight of the foetus, the period of gestation at delivery, the place of delivery and the birth attendant in the case of home deliveries. The format that was used for this is shown in Appendix H.

3.3 Evaluation of the form

The different authors, whose forms were studied prior to formulation of the study/designed form, have used various sampling techniques to draw the samples for testing their forms. Both Nesbitt et al. (1969) and Coopland et al. (1977) have used 1,001 consecutive patients at their first perinatal visit and 5,459 consecutive patients admitted to the labour ward respectively for the testing of the forms relating the outcome to the score. There were a sufficient number of perinatal deaths in these two large populations to make meaningful comparison between scores and outcome of pregnancy.

Wilson et al. (1973), in his study, tested the form in two groups of patients. The first group comprised 148 patients selected randomly from patients booking early in pregnancy. This group was studied prospectively and the second group of 150 patients were surveyed retrospectively. The second group was weighted with a number of perinatal deaths. The two groups were then combined and their scores studied with respect to outcome.

In this present study, because of time constraints, a small

sample of 100 antenatal mothers were randomly selected for prospective scoring. While a second group of mothers, all of whom had perinatal deaths in the year 1978, were scored retrospectively and the two groups combined to study the relationship of the risk scores to the outcome.

The district of Kuala Pilah was chosen for the study because it is a district with (i) urban rural distribution of population and (ii) the wide distribution of health facilities which is fairly representative of the country in general. It is one of the districts in Negri Sembilan, the state in which the writer had worked previously. It has an area of 956 square miles and a population of 146,244. 76 per cent of the population live in the rural areas. The wide distribution of health facilities is shown in Appendix L. There are altogether

35 jururawat desa and midwife clinics

6 health subcentres

1 main health centre

1 maternal and child health centre, all of which provide domiciliary midwifery services and antenatal care for the mother, and 1 district hospital. The district hospital has no obstetrician. Most deliveries are conducted by midwives or staff nurses. Only in cases of problems, which the staff nurse cannot handle, the medical officer is called, and those which the medical officer cannot handle are referred to the General Hospital in

Seremban, the nearest hospital with an obstetric specialist.

Sample for prospective testing:

A list of all the antenatal mothers who were attending rural health clinic in the district and who had their last menstrual period in March 1978 was drawn up. This was to ensure that the group of mothers would be delivering in or about December 1978. (The time scheduledfor collecting data for the dissertation). The mothers were defined by their last menstrual period, so that any mother who delivered prematurely would also be included in the sample. If mothers having their expected date of delivery in December had been chosen in December, this would have given a false impression of mothers having delivered at term. Mothers delivering prematurely would have been excluded. By the above definition there were 267 mothers in the district. Using a table of random numbers, 100 mothers were selected from this group for this study.

The clinics which these mothers were attending were visited by the writer. Wherever the clinic happended to be holding its antenatal session the writer visited the clinic and examined selected mothers that were present and the findings in the antenatal cards were confirmed. This was only done for 17 mothers. For the rest the antenatal card was studied and from the record available in the card the risk score was calculated.

Part II of the form with the name and reference number of the mother on it, was left with the Public Health Nurse or Staff Nurse in charge of the nearest subcentre and under whose supervision the clinic was. When the mother had delivered, one week was given to see the outcome of the surviving infant after which the form was completed and sent to the writer.

Sample for retrospective testing:

In this category, all mothers with perinatal deaths in 1978 and who were certain of their last menstrual period were included. Their antenatal records were used to obtain the risk score in the same way as the prospective samples. For this study, the only difference between the prospective group and the retrospective group is that in the latter the outcome was already known prior to scoring. In the former the outcome was not known prior to scoring. However, in the prospective group, a few were scored retrospectively, i.e. those that had premature deliveries.

3.4 Statistical analysis

3.4.1 Test of significance to be used:

(i) Chi-square test

Formula: $$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

where χ^2 = chi-square

f_o = observed frequency

f_e = expected frequency

and the differences in the observations are considered significant if $p < 0.05$.

(ii) t-test for significance of difference between 2 sample means

Formula: $$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}}$$

where $\bar{X}_1$ = mean of sample from first distribution

$\bar{X}_2$ = mean of sample from second distribution

S_p^2 = pooled estimate of the universe variance obtained from pooling of the variances of the 2 samples

n_1 = sample size of first distribution

n_2 = sample size of second distribution

3.4.2 Test for Reliability of form

Reliability is tested by its sensitivity and specificity.

Sensitivity = ability of the test to give a positive finding (in this case a high risk score) when the foetus scored is truly at risk.

Specificity = ability of the test to give a negative finding (in this case a low risk score) when the foetus scored is not at risk.

$$\text{Sensitivity} = \frac{a}{a+c}$$

$$\text{Specificity} = \frac{b}{b+d}$$

Score \ Risk	High	Low	
High	a	b	a+b
Low	c	d	c+d
	a+c	b+d	a+b+c+d

3.5 Constraints

3.5.1 In designing the form:

Perinatal mortality rates in the local population were not available for every factor that was used in the designed/study form. The figures that were available were quoted to show the risk trend in the country and were not used in changing the scores, which in most factors was not altered from the index form.

3.5.2 In testing the designed form:

(a) Since both prospective as well as retrospective scoring was done in order to test the form, some of the information needed for scoring was not available. For example, though height was included because it is an easy measurement to take if necessary, not all mothers had their heights

recorded and hence this was not used in actual scoring for all the mothers.

(b) Haemoglobin values varied from clinic to clinic for the same haemoglobin level because 2 different brands of Sahli's haemoglobinometer were being used. Adjustments had to be made after comparing the values with the values obtained by the calorimetric method. This could not be done for those who were scored retrospectively. Hence the mother was not considered anaemic unless the haemoglobin was shown to be persistently low.

(c) Urine sugar - if urine sugar was found to be green in order to consider it positive the urine would have to be retested after overnight fasting. However this could not be done in those scored retrospectively. However this did not pose a problem because no mother fell into this category.

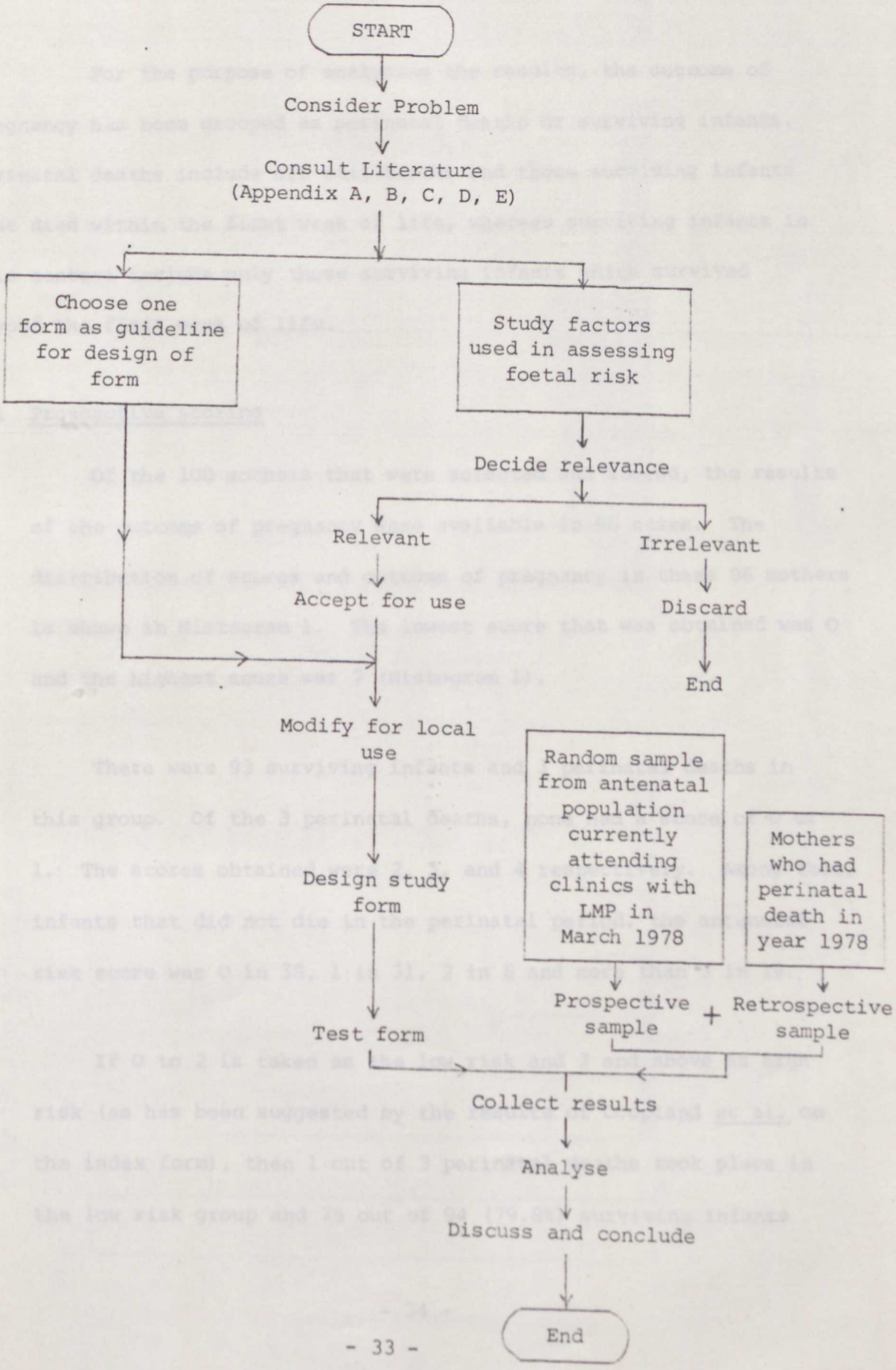
3.5.3 In recording outcome of pregnancy:

(a) Although Apgar score was to be included as one of the ways of assessing the outcome of the foetus, this had to be excluded because there was no conformity in scoring and not every baby was scored.

(b) Birth weights were subject to a large margin of error because of the use of different types of weighing scales. In home deliveries a spring scale is used

and this is highly inaccurate. Also, in the case of bidan kampung deliveries no weight is taken until after a few days. Hence, weight was not used in showing any relationship to outcome of pregnancy.

Flow Chart Showing the Methodology Schematically



4. RESULTS

For the purpose of analysing the results, the outcome of pregnancy has been grouped as perinatal deaths or surviving infants. Perinatal deaths include all stillbirths and those surviving infants that died within the first week of life, whereas surviving infants in this context include only those surviving infants which survived beyond the first week of life.

4.1 Prospective scoring

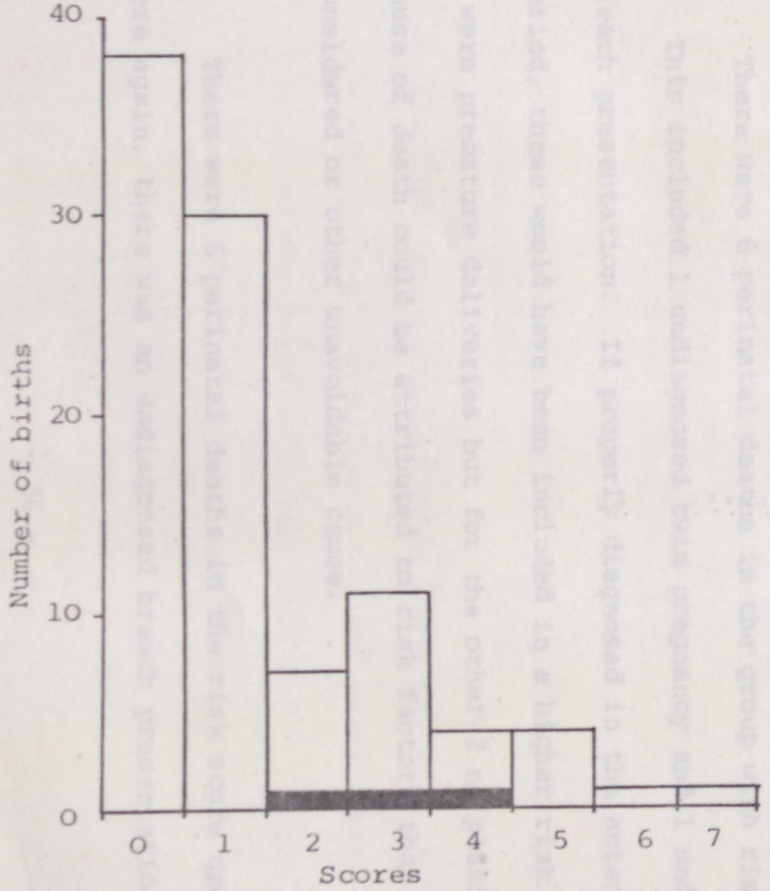
Of the 100 mothers that were selected and scored, the results of the outcome of pregnancy were available in 96 cases. The distribution of scores and outcome of pregnancy in these 96 mothers is shown in Histogram 1. The lowest score that was obtained was 0 and the highest score was 7 (Histogram 1).

There were 93 surviving infants and 3 perinatal deaths in this group. Of the 3 perinatal deaths, none had a score of 0 or 1. The scores obtained were 2, 3, and 4 respectively. Among those infants that did not die in the perinatal period, the antenatal risk score was 0 in 38, 1 in 31, 2 in 6 and more than 3 in 19.

If 0 to 2 is taken as the low risk and 3 and above as high risk (as has been suggested by the results of Coopland et al. on the index form), then 1 out of 3 perinatal deaths took place in the low risk group and 75 out of 94 (79.8%) surviving infants

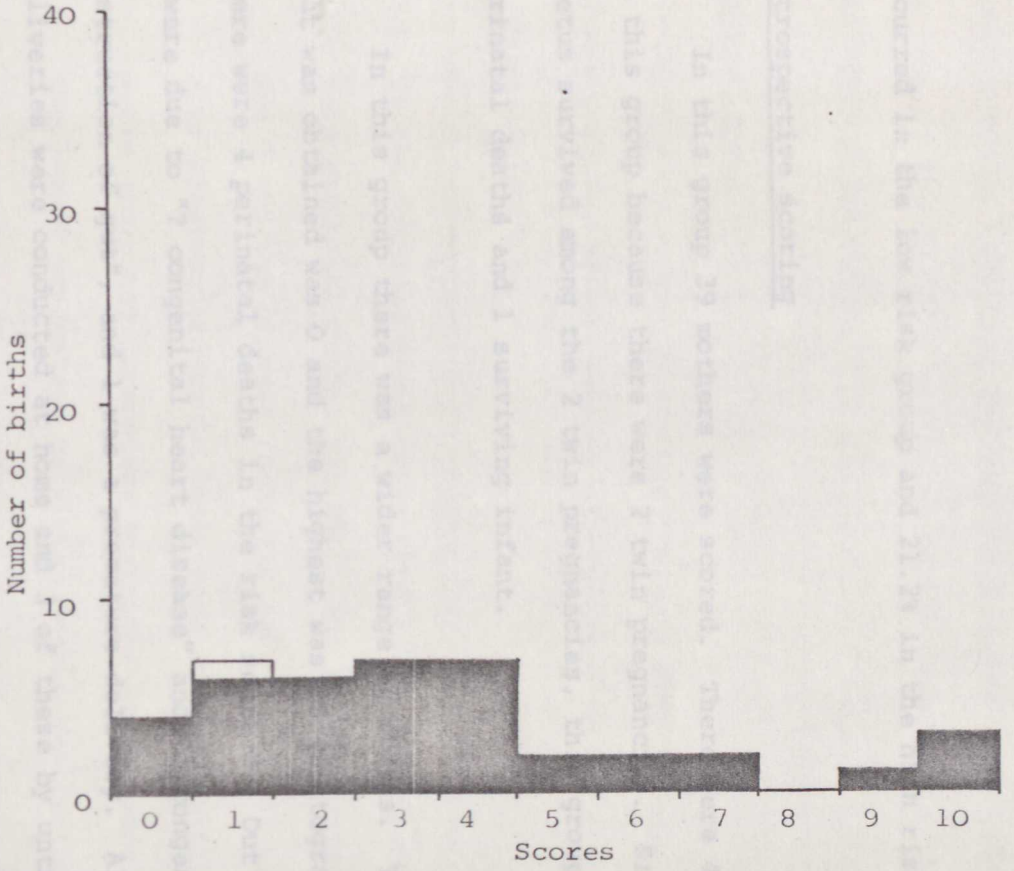
Histogram 1

Histogram showing the distribution of risk scores and outcome of pregnancy in foetal risk scoring done prospectively



Histogram 2

Histogram showing the distribution of risk scores in foetal risk scoring done retrospectively



livebirth (alive after 1 week) perinatal death

occurred in the low risk group and 21.2% in the high risk group.

4.2 Retrospective scoring

In this group 39 mothers were scored. There were 41 births in this group because there were 2 twin pregnancies. Since 1 foetus survived among the 2 twin pregnancies, this group had 40 perinatal deaths and 1 surviving infant.

In this group there was a wider range of scores. The lowest that was obtained was 0 and the highest was 10 (Histogram 2). There were 4 perinatal deaths in the risk score 0. Out of these 2 were due to "? congenital heart disease" and "? congenital obstruction of gut", and 1 was a premature delivery. All 4 deliveries were conducted at home and 3 of these by untrained personnel.

There were 6 perinatal deaths in the group with risk score 1. This included 1 undiagnosed twin pregnancy and 1 undiagnosed breech presentation. If properly diagnosed in the antenatal period, these would have been included in a higher risk category. 2 were premature deliveries but for the other 2 no possible cause of death could be attributed to risk factors that were considered or other unavoidable cause.

There were 6 perinatal deaths in the risk score group of 2. Here again, there was an undiagnosed breech presentation which

should actually have been included in a higher risk category. The rest of the 24 (60%) perinatal deaths occurred in those with risk score 3 and above.

4.3 Combined group

For all further analysis the 2 groups will be combined and the relationship of the outcome of pregnancy to the risk score is as shown in Table 1.

4.3.1 In the combined group there were 137 births of which 43 were perinatal deaths (31.4%). The lowest score obtained was 0 and the highest score was 10. These 137 births were classified according to their risk scores. Within each risk score group the percentage perinatal deaths were calculated. The lowest percentage perinatal deaths was in the group with risk score 0 and the highest percentage perinatal death was in the groups with risk score 9 and 10. Between these 2 extremes the percentage perinatal deaths were intermediate between the two extreme scores but a definite rising percentage perinatal loss with increasing perinatal score was not seen because of the small numbers in each group.

4.3.2 The data represented in Table 2 was analysed using a chi-square test of significance and the p-value that was obtained was found to be less than 0.001. Hence, this suggests that the observed differences in the distribution

Table 1: Showing relationship of risk score to the outcome of pregnancy

Risk Score	Perinatal Death (1)	Surviving Infants (2)	Total Births (1) + (2)	% Perinatal Death
0	4	38	42	9.5
1	6	31	37	16.2
2	7	6	13	53.8
3	8	10	18	47.0
4	8	3	11	72.7
5	2	4	6	33.3
6	2	1	3	66.6
7	2	1	3	66.6
8	0	0	0	-
9	1	0	1	100.0
10	3	0	3	100.0
Total	43	94	137	31.4

Footnote:

$$\% \text{ perinatal death} = \frac{\text{Perinatal deaths}}{\text{Total births}} \times 100$$

Table 2: 4-fold table constructed to perform the χ^2 test and tests for sensitivity and specificity

Risk Score	Pregnancy Outcome		
	Perinatal Death	Surviving Infants	Births
High (3 - 10)	26	21	47
Low (0 - 2)	17	73	90
	43	94	137

$$\chi^2 = 18.84$$

$$p < 0.01$$

Sensitivity = 60.5%

Specificity = 77.7%

of scores in the group with perinatal loss and in the group with surviving infants were highly significant.

4.3.3 The sensitivity and specificity of the form in detecting the foetus at risk was also calculated (Table 2). If those having risk scores 0 to 2 are classified as low risk and those having risk scores 3 and above as high risk, the sensitivity was found to be 60.5% and the specificity was found to be 77.7%.

4.3.4 Table 3 shows the measures of central tendency of the risk scores in the group where the outcome were surviving infants and in the group where the outcome of pregnancy were perinatal deaths. The mean score in the 43 perinatal deaths was 3.5, with a median of 3 and a mode of 3 to 4. The mean score in the 94 surviving infants was 1.2, with a median of 1 and a mode of 0. The differences between the mean risk scores in the births resulting in perinatal deaths and those resulting in surviving infants was analysed using t-test for differences between means. The p-value that was obtained was less than 0.001 showing that the difference between the mean scores is significant.

4.3.5 Tables 4, 5 and 6 show the relationship of the risk score and outcome of pregnancy to hospital delivery, home deliveries conducted by government midwife and home

Table 3: Showing the measures of central tendency of the risk scores to the outcome of pregnancy

Pregnancy Outcome	Mean Risk Score	Median Risk Score	Modal Risk Score
Surviving Infants	1.3	1	0
Perinatal death	3.5	3	3 - 4

t-test for difference between mean scores

$t = 6.959$

$df = 135$

$p \quad 0.01$

Table 4: Showing relationship of risk score and outcome of pregnancy to hospital delivery

Pregnancy Outcome	Risk Score		
	0 - 2	3 - 5	6
Perinatal Death	10 (15.9%)	8 (42.1%)	6 (75.0%)
Surviving Infant	53 (84.1%)	11 (57.9%)	2 (25.0%)
Total Births	63 (100.0%)	19 (100.0%)	8 (100.0%)

Table 5: Showing relationship of risk score and outcome of pregnancy to home deliveries conducted by government midwife

Pregnancy Outcome	Risk Score		
	0 - 2	3 - 5	6
Perinatal Death	1 (5.3%)	6 (50.0%)	0
Surviving Infant	18 (94.7%)	6 (50.0%)	0
Total Births	19 (100.0%)	12 (100.0%)	0

Table 6: Showing relationship of risk score and outcome of pregnancy to home deliveries conducted by untrained personnel

Pregnancy Outcome	Risk Score		
	0 - 2	3 - 5	6
Perinatal Death	6 (60.0%)	4 (100.0%)	2 (100.0%)
Surviving Infant	4 (40.0%)	0 (0.0%)	0 (0.0%)
Total Births	10 (100.0%)	4 (100.0%)	2 (100.0%)

untrained personnel - includes deliveries by bidan kampung

deliveries conducted by untrained personnel respectively.

Among the hospital deliveries the percentage perinatal deaths was 15.9 in the group with risk scores 0 to 2, 42.1 in the group with risk scores 3 to 5 and 75 in the group with risk scores equal to 6 or more. While in the home deliveries conducted by government midwives the percentage perinatal deaths were 5.3 and 50.0 in the groups with risk scores 0 to 2 and 3 to 5 respectively. No delivery in the group with risk score of 6 or more was conducted by a government midwife in the home. In the home deliveries conducted by untrained personnel the percentage perinatal deaths was found to be 60 in the group with risk score 0 to 2 and 100 in the groups with risk score 3 to 5 and more than or equal to 6.

It seems to indicate that whatever the place of delivery the percentage of perinatal deaths increases with increasing risk scores. One interesting feature is that percentage perinatal loss is high even in the low risk group when the delivery is conducted by untrained personnel.

4.3.6 Table 7 shows the relationship of risk score and outcome of pregnancy to period of gestation at delivery. It seems to show that prematurity is also a major factor in the perinatal deaths. Apparently even when the foetal risk score was low perinatal death resulted if the delivery was

Table 7: Showing relationship of risk score and pregnancy outcome to period of gestation at delivery

Gestational Period at Delivery and Pregnancy Outcome		Risk score		
		0 - 2	3 - 5	6
Less than 32 weeks	Perinatal Death	3 (100.0%)	0 (-)	2 (100.0%)
	Surviving Infant	0 (0.0%)	0 (-)	0 (0.0%)
	Total Births	3 (100.0%)	0 (-)	2 (100.0%)
32 weeks to 36 weeks	Perinatal Death	4 (44.4%)	8 (72.7%)	4 (100.0%)
	Surviving Infant	5 (55.6%)	3 (27.3%)	0 (0.0%)
	Total Births	9 (100.0%)	11 (100.0%)	4 (100.0%)
37 weeks or more	Perinatal Death	10 (12.5%)	10 (41.7%)	2 (50.0%)
	Surviving Infant	70 (87.5%)	14 (58.3%)	2 (50.0%)
	Total Births	80 (100.0%)	24 (100.0%)	4 (100.0%)

premature.

4.3.7 Table 8 shows that in the groups with risk score 0 to 1, 2 to 5 and more than or equal to 6 respectively, the percentage of births reaching 37 weeks of gestation prior to delivery were 87.0, 68.6 and 40.0 per cent. Hence it shows that with increasing risk score the percentage of pregnancies reaching 37 weeks or more prior to delivery decreases.

Table 8: Showing relationship of risk score and gestational period at delivery

Gestational period at delivery	Risk score		
	0 - 2	3 - 5	6
Less than 37 weeks	12 (13.0%)	11 (31.4%)	6 (60.0%)
37 weeks or more	80 (87.0%)	24 (68.6%)	4 (40.0%)
Total births	92 (100.0%)	35 (100.0%)	10 (100.0%)

5. DISCUSSION AND IMPLICATIONS

This was an exploratory study to develop a simple scoring system for use by auxiliaries in Malaysia. The aim of developing such a risk scoring system was to enable them to detect mothers at risk of perinatal foetal loss. Under the system a score was given to each of a list of selected risk factors in order to quantitatively define the risk of perinatal death to the foetus in utero in terms of risk score. A high risk score meant that a foetus was at high risk of dying in the perinatal period, while a low score meant that risk of perinatal death was lower.

For the purpose of evaluation of the form, it was tested on two groups of mothers as done in the study by Wilson et al. (1973). In the first group a random sample of 96 mothers were chosen and scored prospectively and the score related to outcome. In the second group all the mothers with perinatal deaths in 1978 in the district were scored retrospectively, and the score related to outcome. The two groups were then combined to show the relationship of the risk score to foetal loss. The lowest score obtained was zero and the highest was 10.

The study showed that with an increasing risk score the risk of perinatal death increased. The risk was low at scores 0 and 1 and increased sharply at 2, varying between 40 to 70 per cent in the risk scores between 2 and 7. At risk score 9 and 10, the foetal risk was

found to be high, resulting in 100 per cent perinatal death, among births in this category. On carrying out tests of significance using chi-square test, the results observed were shown to be significant, with p-value of less than 0.001. The sensitivity and specificity were found to be 60.5 per cent and 77.7 per cent respectively.

The findings suggest that patients whose risk score are between 0 or 1 be considered at low risk, those whose score are between 2 and 5 as moderate risk and those with risk scores of 6 and above as high risk of perinatal loss.

This relationship of risk score to perinatal mortality was similar to that shown by Coopland et al. (1977) whose risk scoring system was used as an index form in this study. Besides this relationship to perinatal mortality rate, Coopland et al. (1977) also demonstrated that (i) as the risk score increased the percentage of favourable Apgar ratings decreased, (ii) an increasing risk score was associated with an increasing percentage of low birth weight infants in two groups, those weighing less than 1,500 gm and those weighing between 1,500 gm and 2,500 gm, (iii) increases in prematurity were directly proportionate to increase in risk score, (iv) increases in percentage of infants requiring special care nurseries increased more than 10-fold from score 0 to 7. In this study only the relationship between risk score and prematurity could be shown, the rest could not be shown because of reasons stated under constraints.

In this study a comparison was also made to show the relationship of the outcome of pregnancy and the risk score to the place of delivery and attendant. It showed that whatever the place of delivery the percentage of perinatal death increased with increasing risk score. One interesting feature was apparently the percentage of perinatal loss was high even in the lower risk group when deliveries were conducted by untrained personnel which includes the bidan kampung.

The perinatal loss in government hospital seemed to be higher in the low and moderate risk groups compared with deliveries in home conducted by government midwives. This was probably due to the fact that these cases were not recognised as risk cases and accepted for home delivery and referred only when problems arose during labour, when it was too late and the hospital was far from the home.

As mentioned earlier, most deliveries conducted in the district hospital are done by government midwives, but the only difference is that they have slightly better facilities and further help is available to them at short notice.

The other thing shown in the study was the relationship of the risk score and the outcome of pregnancy to period of gestation and delivery. It seemed to show that prematurity was also a major factor in perinatal death. Apparently, even when foetal risk score was low, perinatal death resulted if delivery was premature. The

study also showed that with increasing risk score the percentage of pregnancy reaching 37 weeks or more prior to delivery decreased.

On the basis of the present study, therefore, it seems the study/designed form has a potential use as a foetal risk detecting system that could be used by auxiliaries.

According to Sokol et al. (1977), there are two requirements for a risk scoring system to be used effectively. The first requirement is that the scoring system must be simple enough to be done easily by those who are actually going to use it. In this respect, the study/designed form meets the requirements because the factors chosen for scoring are simple enough for auxiliaries to detect and which are already being carried out as routine. All that the study/designed form will do is to help in quantifying the risk.

The second requirement for a risk scoring system to be effective is that it must appropriately identify patients likely to have a poor pregnancy outcome. As shown earlier the sensitivity and specificity were found to be 60.5% and 77.7% respectively when the cut-off point was put at 2 (i.e. those with risk score 3 and above be considered at high risk).

With this sensitivity and specificity and on the assumption that (i) the prevailing perinatal mortality for this country is 35/1000 livebirths, and (ii) there are about 300,000 livebirths/year, then one would have to classify 20% of the antenatal population as high

risk in order to pick out 60% of the foetuses at high risk.

The sensitivity can be increased by reducing the cut-off point to 1 but only at the cost of reducing the specificity. This would then increase the workload of the hospitals. The cut-off point therefore will depend on whether we want a higher sensitivity or a higher specificity and will in turn affect these values. It would be better determined after testing this form on a larger sample.

The study/designed form, besides being a tool for the identification of foetus at risk, also has a number of other advantages. In fact, it can act as an educational tool, helping to increase the awareness of medical obstetric problems leading in turn to better outcome and carrying out of tests and examinations on an antenatal mother with greater realisation of its importance. Aubry and Pennington (1973) have shown that it improves the vigilance and resultant care at the potential referral source by increasing awareness of risk consideration.

The other advantage is that the study/designed form will help in guiding the auxiliary in her examination and in determining the cut-off point at which she can take remedial measures on her own or refer for further management.

As pointed out by Sokol et al. (1977) it is important to recognise that risk scoring is only a screening technique and cannot be expected to identify all problems. Early identification is necessary,

but not sufficient for achieving the best perinatal outcome. There will, undoubtedly, be cases in which risk factors are present but are not recognised and hence not included in the scoring, thus placing a mother at high risk with a low risk category. This fact was clearly borne out in this study, where two out of the six breech deliveries and both the twin deliveries were not diagnosed until after delivery.

It is also clear that not all patients at risk will receive the best management because this will depend on whether the mother will follow the advice of the auxiliary especially when clinics are so far from the hospital. In the Kuala Pilah district, for example, the distance between the district hospital and the furthest clinic is 47 miles.

It has been seen from the writer's experience that whenever an auxiliary persists on advising hospital delivery, mothers end up in bidan kampung delivery, which carries a high risk of perinatal death even among mothers with low risk score.

In conclusion, it could be said therefore that the study/designed form could be used with certain limits of accuracy in a rural setting to help identify patients at increased risk of poor perinatal outcome. However, further studies will have to be conducted to further refine the scoring system and the design of the form.

6. SUMMARY

Seemingly unrelated events such as parity, age of mother, prior obstetrical complications, antepartum complications, etc., have been noted by workers such as Prechtl (1967) and Goodwin et al. (1963) as having a cumulative effect on the ultimate foetal risk. Also, multivariate analysis of the findings of the British Perinatal Mortality Survey of 1958 have singled out factors such as social and biological characteristics of the mother, the obstetrical history, the course of gestation and the birth of the baby as having a major influence on perinatal mortality (W.H.O. Public Health Papers No. 42).

Based on these and other such statistical analyses various workers have attempted scoring systems for the identification of the foetus at risk. The objective of this study was to design a similar form for the identification of the foetus at risk, modified for local use and needs.

In a developing country like Malaysia, with its limited financial and trained manpower resources, obstetrical care is still being provided by auxiliaries to the rural population, which accounts for 70% of the total population. Hospital and specialist obstetric services are available in major towns. From the foregoing, it was considered that it would be of great advantage if a simple scoring system for the identification of high risk pregnancies for use by auxiliaries in rural areas be formulated.

For the purpose of designing a risk scoring form (study/designed form) for this study, 4 scoring systems viz those used by Nesbitt et al. (1969), Goodwin et al. (1969), Wilson, et al. (1973) and Coopland et al. (1977) were considered in conjunction with the antenatal recording card which is currently being used for recording the examination findings in an antenatal mother attending any rural health clinic in Malaysia.

Selection of factors for use in the assessment of the foetal risk, in the study/designed form, was based on the following criteria:

(i) that the factors should be those for which particulars are routinely obtained from antenatal mothers attending any rural health clinic.

(ii) that the recognition of the factor should be within the technical capabilities of the auxiliary.

The decision for the scoring system that could be used as an index for designing the study form was based on the following criteria:

(i) the scoring system should be easy to understand.

(ii) the scoring system which could be adapted with the minimum of modifications.

Having thus designed the form, it was evaluated by using the form to score 2 groups of mothers, one prospectively, and the other retrospectively. The only difference between the 2 groups being that in the former the outcome was not known prior to scoring and in the

latter, the outcome was already known before scoring. The former group consisted of a group of 100 mothers selected randomly from those mothers whose last menstrual period was in March 1978 and who were attending rural health clinics in Kuala Pilah, and the latter group consisted of all the mothers in the same district who had a perinatal death during the whole of 1978.

Altogether 135 mothers were scored, 96 in the prospective group and 39 in the retrospective group. This resulted in 137 births because there were 2 twin deliveries. Among these, there were a total of 43 perinatal and 96 surviving infants.

The lowest score recorded was 0 and the highest score recorded was 10. When the 137 births were tabulated according to the risk score it was shown in the group with risk score 0 the percentage perinatal deaths was 9.5 and in the group with risk score 1 it was 16.2. Between risk score 2 to 7 the percentage perinatal deaths was higher than in the group with risk score 1. However a steady rise in percentage perinatal deaths with increasing score was not apparent probably because of the small numbers in each group. For the risk scores 9 and 10, the percentage perinatal death was 100%.

A test of significance using the chi-square test gave a p-value of < 0.001, hence suggesting highly significant results. The sensitivity and specificity of the risk scoring form was found to be 60.5% and 77.7% respectively.

By relating the risk scores and outcome of pregnancy to place of delivery and birth attendant it seemed to indicate that whatever the place of delivery the percentage perinatal death increases with increasing risk scores. It was apparently shown that percentage perinatal loss was high even in the low risk group where the delivery was conducted by untrained personnel.

When the risk scores and outcome of pregnancy were related to period of gestation at delivery it seemed to show that prematurity was a major factor in the perinatal death irrespective of risk score. It also showed that with increasing risk score the percentage of pregnancies reaching 37 weeks gestation or more prior to delivery decreased from 92.4% in the risk score group 0 to 1 to 40% in the group with risk score of more than or equal to 6.

In conclusion, this form seems to have a potential for use in detecting the foetus at risk. However, further widescale tests need to be carried out to confirm the validity of the scoring system.

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FORM DESIGNED BY NESBITT, et al. (1969)

Table I

Maternal-Child Health Care Index

Name: _____ *Date:* _____ *EDC:* _____ *Hospital:* _____

& Number: _____

The scoring system below is an attempt to categorize the degree of maternal and fetal risk based on the information available at the initial history and physical upon registration in our obstetric clinics. Please circle the numbers under each of the 8 categories which you feel apply and, at the bottom of this sheet, add up these numbers and subtract from a perfect score of 100

I. *Maternal age*

Under 15	20
15-19	10
20-29	0
30-34	5
35-39	10
Over 40	20

II. *Race and marital status*

White	0
Nonwhite	5
Single	5
Married	0

III. *Parity*

0	10
1-3	0
4-7	5
Over 8	10

IV. *Past obstetric history:*

Abortions	*Prematures*	*Fetal death*	*Neonatal death*	*Congenital anomaly*	*Damaged infants*
1 5	1 10	1 10	1 10	1 10	Physical 10
2 15	2+ 20	2+ 30	2+ 30	2+ 20	Neurological 20
3+ 30					

V. *Medical-obstetric disorders and nutrition:*

Systemic illnesses		*Specific infections*		*Diabetes*		*Chronic hypertension*	
Acute, mild	5	Urinary:		Pre	20	Mild	15
Acute, serious	15	acute	5	Overt	30	Severe	30
Chronic, nondebilitating	5	chronic	25			Nephritis	30
Chronic, debilitating	20	Syphilis:		*Heart disease*			
		treated	0	Class I or II		10	
		untreated	20	Class III or IV		30	
		at term	30	History prior failure		30	

Endocrine disorders		*Anemia*	
Definite adrenal, pituitary, or thyroid problem	30	Hgb. 10-11 Gm.	5
Recurrent menstrual dysfunction	10	Hgb. 9-10 Gm.	10
Involuntary sterility: Less than 2 years	10	Hgb. less than 9 Gm.	20
More than 2 years	20		

Rh problem		*Nutrition*	
Sensitized	30	Malnourished	20
Prior infant affected	30	Very obese	30
Prior ABO incompatibility	20	Inadequate diet but not malnourished	10

VI. *Generative tract disorders*

Prior fetal malpresentations	10
Prior cesarean section	30
Known anomaly or incompetent cervix	20
Myomas: Over 5 cm.	20
Submucous	30
Contracted pelvis:	
Borderline	10
Any contracted plane	30
Ovarian masses: Over 6 cm.	20
Endometriosis	5

VII. *Emotional survey* (Grade 0-20 based on): Fears, attitudes, biases, hostilities, motivations, and behavioral patterns—prior pregnancies without supervision; time of registration; standard of child care and responsibilities; family unit; marital relationship; history of psychiatric illness in family

VIII. *Social and economic survey* (Grade 0-10 based on): Employment—husband, patient; annual income adequacy, public assistance; education—husband, patient; housing—location, quality, facilities, and neighborhood environment

Total score of all 8 categories _____

100 less above score equals MCH Care Index _____

FORM DESIGNED BY GOODWIN, et al. (1969)

TABLE III.—Antepartum Fetal Risk Score

Baseline data

Age 35+	1
Age 40+	2
Para 0	1
Para 6+	2
Interval < 2 years	1
Obesity (200 lbs.+; 90 kg.+)	1
Diabetes B, C, D	2
F	3
Chronic renal disease	1
with diminished renal function	3
with increased BUN	3

Hypertension (pre-existing)

140+ / 90+	1	160+ / 110+	2

Obstetrical history

Abortion	
Stillbirth	
Neonatal death	
Surviving premature infant	
Antepartum hemorrhage	
Toxemia	
Difficult mid-forceps delivery	
Cesarean section	
Major congenital anomaly	
Baby 10 lbs.+ (or 4.5 kg.+)	
One instance of above	1
Two or more instances in different pregnancies	2
Rh iso-immunized mother	
+ Homozygous father	2
+ History of erythroblastosis	3

SCORE (circle one) 0 1 2 3

Present pregnancy

Bleeding, early (<20 wks.)	
alone	1
with pain	2
Bleeding, late (>20 wks.)	
ceased	1
continues	2
with pain	3
with hypotension	3
Spontaneous premature rupture of membranes	
Latent period 24 hrs.+	2
Anemia <10 g	1
<8 g	2
No prenatal care	2
≤3 prenatal visits	1
Toxemia I	1
Toxemia II	3
Eclampsia	3
Hydramnios (single fetus)	3
Multiple pregnancy	2
Abnormal glucose tolerance	1
Decreasing insulin requirement	3
Maternal acidosis	3
Maternal pyrexia	1
Pyrexia + FHR >160	2
Rh negative:	
With rising titre	2
With amniotic fluid	
Liley zone III	3

SCORE (circle one) 0 1 2 3

Gestational age

28 wks. or under	4
32 wks. or under	3
35 wks. or under	2
37 wks. or under	1
42 wks. or more	1
43 wks. or more	2

SCORE (circle one) 0 1 2 3 4

FORM DESIGNED BY WILSON, et al. (1973)

Table I.—Pregnancy scores

Age		Height		Booking Haemoglobin	
≤16	10	≥152.5cm	0	≥12g %	0
17–30	0	<152.5cm	5	10–12g %	5
31–35	5			<10g %	10
≥36	10				

Married	0	Parity		Booking Blood Pressure	
Single	5	0	10	mmHg	
		1–3	0	<140/90	0
		4+	10	≥140/90	10
				Diastolic >100	20

Husband's Occupation

Semi-skilled and unskilled labour : 5

Medical

Heart Disease:

(a) Normal effort tolerance	10	Neurological	10
(b) Reduced effort tolerance	20	Orthopaedic	10
(c) History of failure	30	Respiratory	10
		Renal (chronic)	10
		Urinary infection	5

Endocrine

(a) Adrenal, pituitary, or thyroid	20
(b) Infertility investigation	10
Insulin treated diabetes	30

Past Obstetric History

Abortion		Premature Labour		Stillbirth		Neonatal Death		Congenital Abnormality	
1	5	1	5	1	20	1	10	1	10
2+	10	2+	10	2+	30	2+	20	2	20

Previous baby weight (add 10 for each additional) ≤2.5kg 20

≥3.8kg 20

Rh Disease (add 10 for each additional) 10

Prior infant affected 20

Previous PET	10	Previous malpresentation	10
Previous essential hypertension	10	Previous forceps delivery	5
Previous accidental haemorrhage	20	Previous post-partum haemorrhage	10
Previous caesarean section	20	Previous retained placenta	10

FORM DESIGNED BY COOPLAND, et al. (1977)

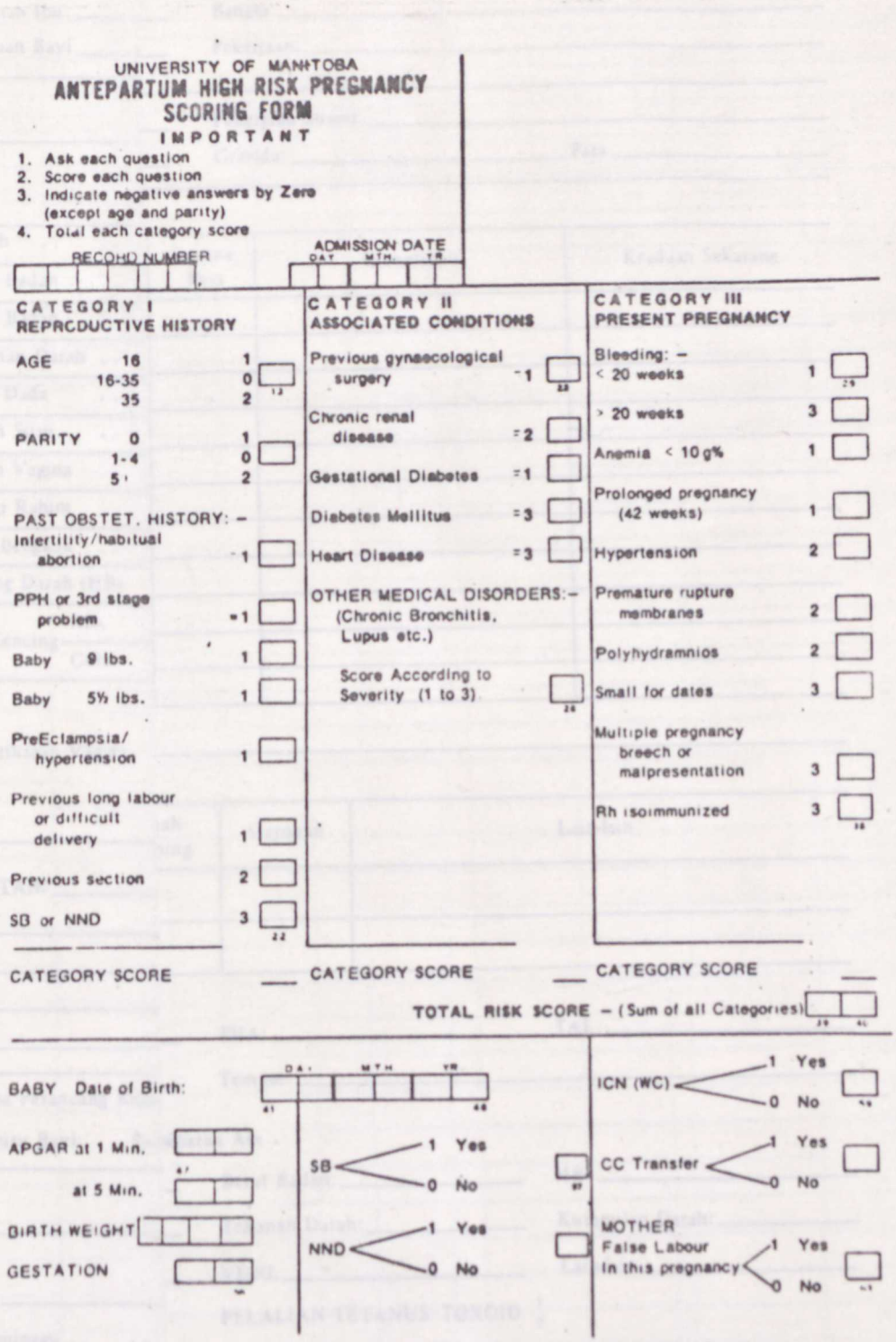


FIG. 1—Original design of antepartum high-risk pregnancy scoring form.

REKOD NATAL

Kelinik: _____ No. K.P. IBU: _____

Tarikh Bersalin: _____ Tempat Lahir: _____

Keadaan Ibu: _____ Jumlah Panggilan: _____

Keadaan Bayi _____ Berat Lahir: _____

JAGAAN POSTNATAL

	Lawatan Ke Rumah (20 hari)	Lawatan Ke Kelinik (42 hari)	Nasihat Pemakanan Perancang Keluarga
Tarikh			
Suhu Badan			
Berat Badan			
Tekanan Darah			
Buah Dada			
Aliran Susu			
Aliran Vagina			
Tinggi Rahim			
Kaki Bengkak			
Kurang Darah (HB)			
Air Kencing — Alb.			
Air Kencing — Gula			
Pemeriksaan Vagina .. — Kemaluan			
Pemeriksaan Vagina .. — Episiotomy/Luka			
Pemeriksaan Vagina .. — Rahim/CX			
Pemeriksaan Vagina .. — Adnexa			

CATITAN: _____

Terima Perancang Keluarga: Ya/Tidak Cara:

Menyusu Bayi: Susu Ibu/Susu Botol

RINGKASAN LAWATAN

Masa Mengandung	Jumlah Lawatan ke Kelinik	Jumlah Lawatan Ke Rumah
0-27 minggu		
28-35 minggu		
36 + minggu – Natal		
Post Natal		

KAD PRANATAL

No. K.P. IBU: _____

Kelinik: _____ Tarikh: _____

Nama: _____ Bangsa: _____

Tarikh Lahir/Umur: _____ Pekerjaan: _____

Alamat: _____

Nama Suami: _____ Pekerjaan Suami: _____

Tarikh Perkahwinan: _____ Gravida: _____ Para _____

PERIHAL KANDUNGAN LALU:

Bil	Hasil Kandungan	Tahun	Tempat Bidan	Jantina Bayi	Komplikasi	Keadaan Sekarang

Amalan perancang keluarga yang lalu: _____

PERIHAL KESIHATAN LALU:

	Tibi	Kencing Manis	Darah Tinggi	Lemah Jantung	Meroyan	Lain-lain
Ada						
Tiada ..						

PERIHAL KANDUNGAN SEKARANG

Bidan yang ditempah: _____ THA: _____ TAL: _____

Jangka masa mengandung: _____ Tempat: _____

KEADAAN KESIHATAN SEKARANG:

Kesihatan Am

Pergigian: _____ Berat Badan: _____ HB: _____

Urat Timbul: _____ Tekanan Darah: _____ Kumpulan Darah: _____

Jantung/Paru: _____ VDRL _____ Lain-lain _____

KEADAAN KAWASAN SEKELILING:

PELALIAN TETANUS TOXOID $\frac{1}{2}$

Keadaan Rumah–

Tandas: _____ Ganti Udara: _____

Bekalan Air: _____ Simpanan Makanan: _____

Saluran air limbah: ☐ Ada: Terbuka/Tertutup ☐ Tiada

Pembuangan Sampah:

☐ Dikambus ☐ Diangkat

☐ Dibakar ☐ Tidak memuaskan

☐ Lain-lain

TARIKH	KELINIK/ LAWATAN RUMAH	PEMERIKSAAN							PEMERIKSAAN LAB				MASAALAH	NASIHAT/RAWATAN	Tarikh Lawatan Akan Datang
		Berat Badan	Tekanan Darah	Buah Dada	Jangka Masa/ Tinggi Rahim	Kedudukan Janin	Jantung Janin/ Gerak Janin	Kaki Bengkak	Kencing		HB	Lain-Lain Butir			
									Albumin	Gula					

APPENDIX F

STUDY/DESIGNED FORM

PART I

Foetal Risk Scoring Form

Patient's Name: .....

Registration Number: .....

Clinic: .....

I. Baseline Data and Reproductive History:

(i) Patient's age: <16 years = 1

16 - 35 years = 0

⩾36 years = 2 ☐

(ii) Parity: 0 = 1

1 - 4 = 0 ☐

⩾5 = 2

(iii) Height: 5 feet or less = 1 ☐

more than 5 feet = 0

(iv) Rhesus grouping: Positive = 0 ☐

Negative = 2

(v) Past Obstetric History:

(a) Abortion No = 0 ☐

Yes = 1

(b) Stillbirth or Neonatal Death (less than 7 days)

No - nil = 0

Yes - only 1 = 2 ☐

more than 1 = 3

(c) Surviving low birth weight infant (<5 lbs)

No = 0

Yes = 1 ☐

(d) Baby more than 9 lbs No = 0

Yes = 1 ☐

(e) Post partum haemorrhage No = 0

Yes = 1 ☐

(f) Antepartum haemorrhage No = 0

Yes = 1 ☐

(g) Toxaemia of pregnancy No = 0

Yes = 1 ☐

(h) Previous caesarean section No = 0

Yes = 1 ☐

II. Associated Conditions:

Hypertension Nil = 0

Yes = 2 ☐

Tuberculosis Nil = 0

Yes = 2 ☐

Heart Disease Nil = 0

Yes = 3 ☐

Diabetes mellitus Nil = 0

Yes = 3 ☐

III. Present Pregnancy:

Haemoglobin	more than 10 gm %	=	0
	8 gm % to 10 gm %	=	1
	less than 8 gm %	=	2
Blood pressure	less than 130/90	=	0
	130/90 - 140/100	=	1
	more than 140/100	=	2
Albumin (urine)	nil	=	0
	present	=	1
Urine sugar	Blue	=	0
	Fasting urine sugar +ve	=	2
Bleeding per vagina at	less than 20 weeks of gestation	=	2
	at 20/52 gestation or more	=	3
Presentation -	normal	=	0
-	abnormal	=	3
Multiple pregnancy	No	=	0
	Yes	=	3
VDRL -	not reactive	=	0
-	reactive/borderline	=	3

SCORE:

I. Baseline Data and Past Obstetric History

II. Associated Conditions

III. Present pregnancy

Grand Score

APPENDIX G

STUDY/DESIGNED FORM

PART II

Outcome of Pregnancy

Patient's name: .....

Registration Number: .....

Clinic: .....

* (i) Condition of foetus at birth

- Live birth ☐
- Fresh stillbirth ☐
- Macerated stillbirth ☐

(ii) Weight of baby ..... lb ..... oz.

(iii) Period of gestation at delivery ..... weeks

(iv) Apgar Score at 1 min .....

10 min .....

* (v) If livebirth condition after 1 week: - Alive ☐

- Dead ☐

* (vi) Place of delivery: Home ☐

Hospital ☐

* (vii) Presentation at birth: Vertex ☐

Breech ☐

Others ☐

* (viii) If home delivery: Bidan kampung ☐

Government midwife ☐

* Tick appropriately

APPENDIX H

Guidelines for Completing the Foetal Risk Scoring Form

Patient's Name: as written in the antenatal card

Registration Number: Identity card number

Clinic: Name of clinic which patient attended for antenatal check

I. Baseline Data and Reproductive History:

(i) Patient's age: age to the last complete year.

(ii) Parity: Number of previous pregnancies terminating after completing 28 weeks gestation.

(iii) Height: to the last complete inch.

(iv) Rhesus grouping: either positive or negative as shown by the laboratory results.

(v) Past obstetric history:

(a) Abortion - any pregnancy terminating prior to completion of 28 weeks gestation, irrespective of whether induced or spontaneous, in the last previous pregnancy.

(b) Stillbirth - pregnancy terminating any time after 28 weeks in a dead foetus in the last previous pregnancy/pregnancies.

Neonatal death - a livebirth dying within 7 days of birth in the last previous pregnancy/ pregnancies.

(c) Surviving low birth weight infant - previous baby with birth weight less than 5 lbs still surviving.

(d) Baby more than 9 lbs - previous baby with birth weight more than 9 lbs.

(e) Antepartum haemorrhage - bleeding per vagina during any previous pregnancy after 28/52 gestation (excluding threatened abortion).

(f) Postpartum haemorrhage - excessive bleeding after delivery irrespective of whether blood transfusion required or not.

(g) Caesarean section - previous delivery by caesarean section.

(h) Toxaemia of pregnancy - blood pressure of 130/90 or more with either oedema or albuminuria in any previous pregnancy.

II. Associated Conditions:

Hypertension - Blood pressure of 130/90 or more in the non-pregnant state prior to present pregnancy.

Tuberculosis - proven case of tuberculosis or history of cough for more than 2 weeks.

Cardiac Disease - proven case of congenital or acquired heart disease with or without effort tolerance.

Diabetes - proven case of diabetes mellitus irrespective of whether on treatment or not.

III. Present Pregnancy:

(a) Haemoglobin: as measured by Sahli's haemoglobinometer.

(b) Blood pressure: as measured by sphygmomanometer.

(c) Albumin: as tested by heating the urine.

(d) Urine sugar: as tested by using Benedict's solution.

positive - if colour is yellow or orange,
or if colour is green for urine tested
after overnight fasting.

negative - if colour is blue.

(e) Bleeding: any bleeding per vagina during present pregnancy irrespective of fresh or stale blood.

(f) Presentation: Normal - vertex presentation

Abnormal - any other presentation other than vertex, e.g. breech, transverse lie.

(g) Multiple pregnancy: if more than one foetus detected.

(h) VDRL: result as stated in the laboratory report.

APPENDIX I

DEFINITIONS

Antepartum Risk Scoring Form : List of selected risk factors to each of which a score is given in order to quantitatively define the risk of perinatal death to the foetus in utero.

Antepartum Risk Scoring : System whereby a mother who is at increased risk of a poor perinatal outcome can be identified using an antepartum risk scoring form.

Bidan kampung : Traditional midwife in Malaysia.

Jururawat desa : Community nurse.

Perinatal death : Total of stillbirth and deaths of infants in the first week of life.

Perinatal mortality ratio : $\frac{\text{Percentage of perinatal deaths which fall in a subgroup}}{\text{Percentage of births which fall in the same subgroup}}$

Risk factor : Ascertainable characteristic of the mother's past obstetric performance, present medical condition or current

pregnancy that is known to be associated with an abnormal risk of death to the foetus in the present pregnancy.

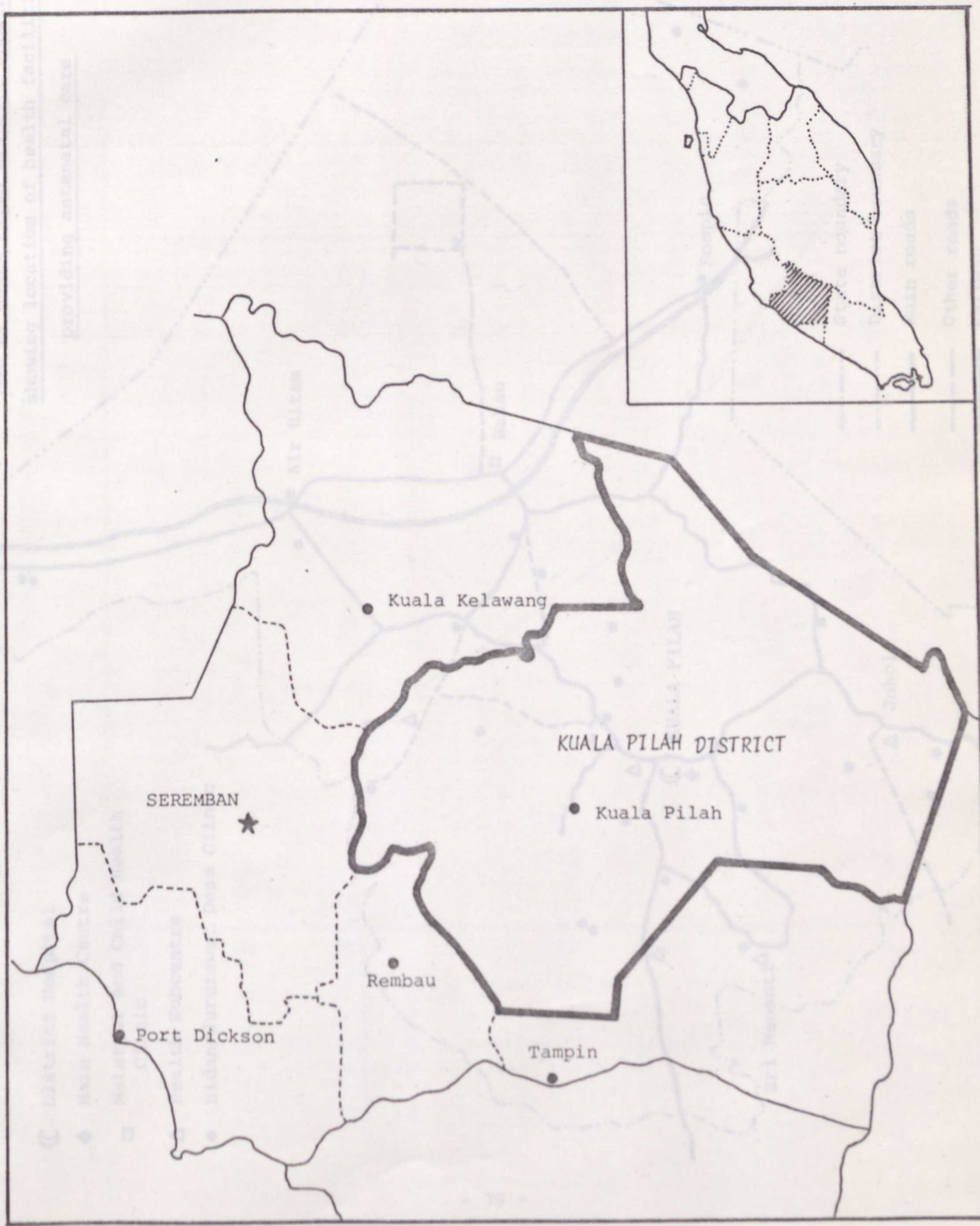
Risk score : Sum total of the scores for all the risk factors ascertained in the present pregnancy.

Second fasting urine sugar : Urine sugar test done on a specimen of urine collected after discarding the overnight urine and passed before the ingestion of any food or sweetened fluid on the morning of the attendance.

Stillbirths : Death prior to the expulsion or extraction from its mother of a product of conception of a gestation of 28 weeks or more. Death is indicated by the fact that after such separation the foetus does not breathe or show any other sign of life.

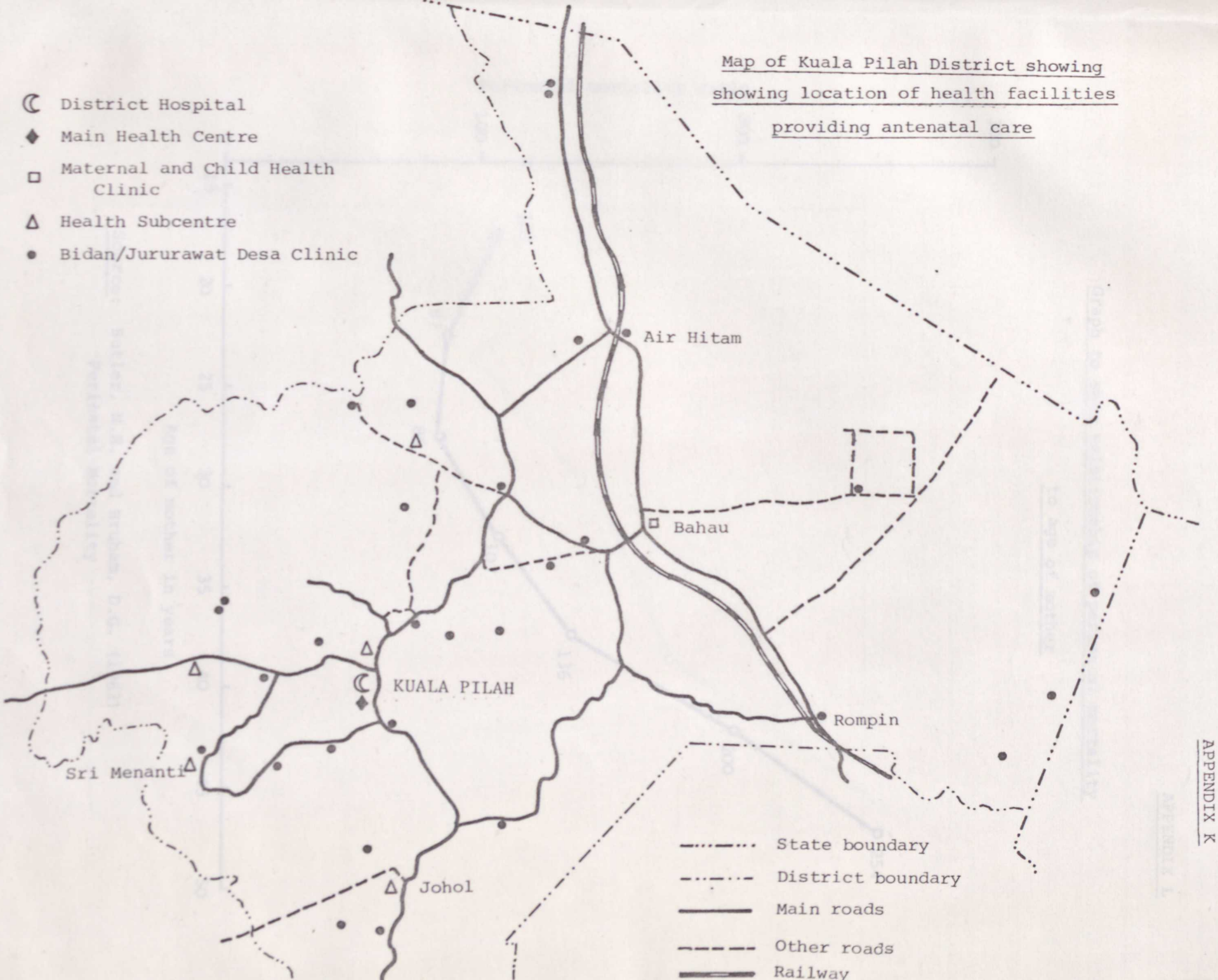
Surviving infants : Livebirths which survived beyond the first week of life.

Map of Negri Sembilan showing the location of Kuala Pilah District

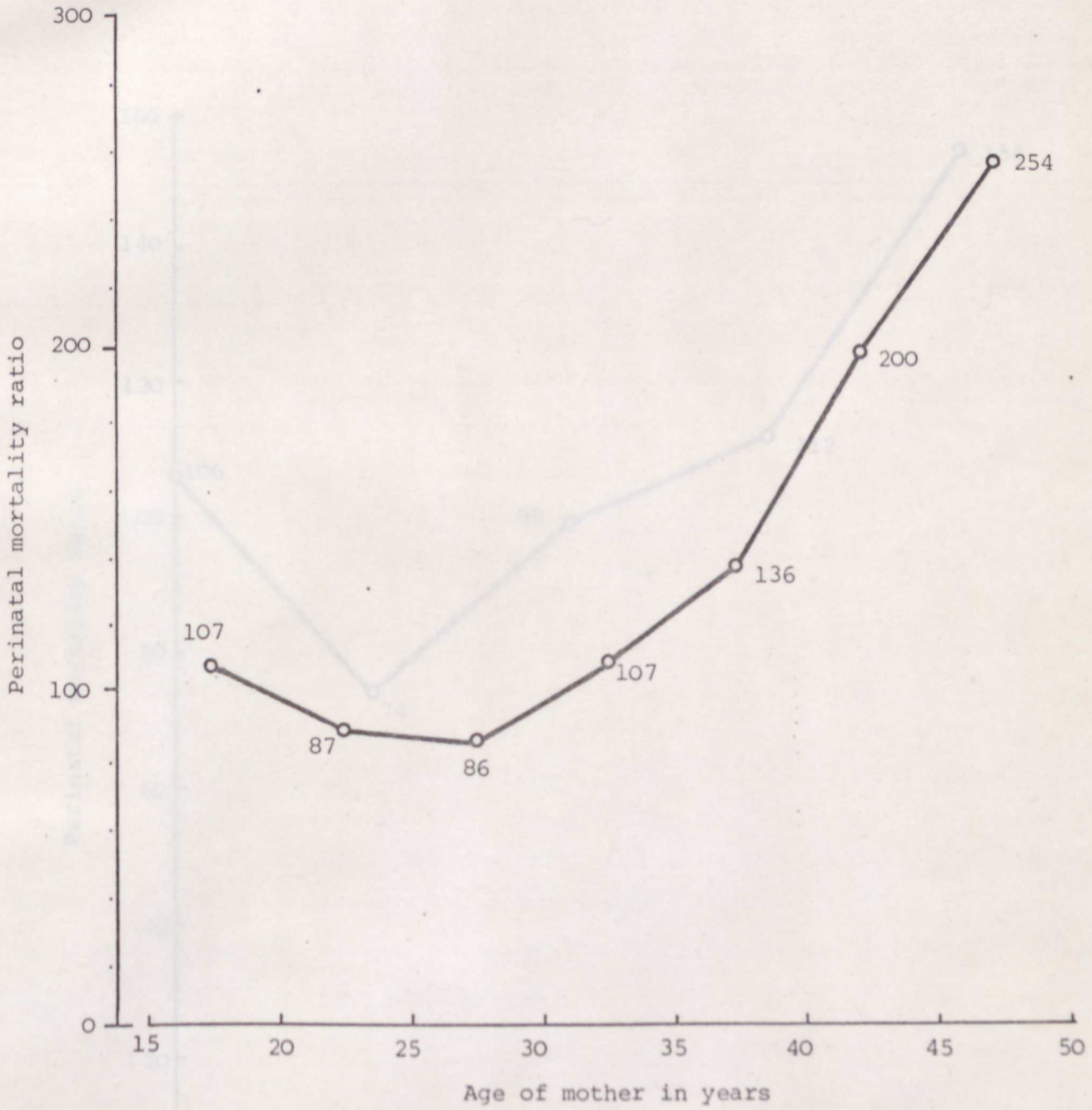


APPENDIX K

Map of Kuala Pilah District showing showing location of health facilities providing antenatal care

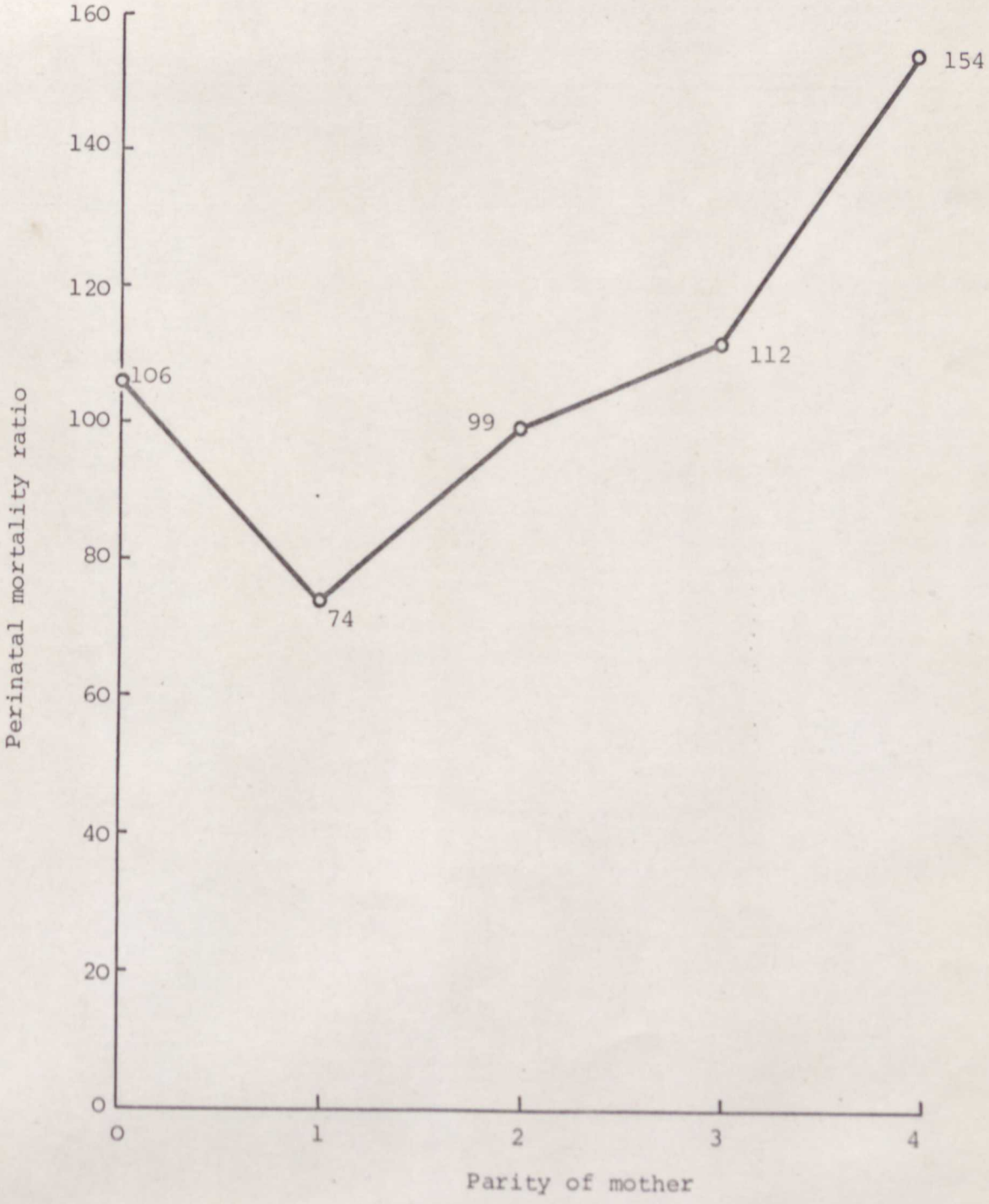


Graph to show relationship of perinatal mortality to age of mother



Source: Butler, N.R. and Bruham, D.G. (1963) Perinatal Mortality

Graph to show relationship of perinatal mortality to parity of mother



Source: Butler, N.R. and Bruham, D.G. (1963) Perinatal Mortality